

March 24, 1892.

Mr. JOHN EVANS, D.C.L., LL.D., Treasurer and Vice-President, in the Chair.

The Right Hon. Spencer Compton Cavendish, Duke of Devonshire, was admitted into the Society.

A List of the Presents received was laid on the table, and thanks ordered for them.

The Croonian Lecture was delivered as follows:—

CROONIAN LECTURE.—“The Temperature of the Brain, especially in relation to Psychological Activity.” By ANGELO MOSSO, Professor of Physiology in the University of Turin. Received March 24, 1892.

(Abstract.)

In his investigations on the temperature of the brain the author has employed, in preference to the thermo-electric pile, exceedingly sensitive mercurial thermometers, constructed specially for the purpose. Since each thermometer contains only 4 grams of mercury, the instruments respond very rapidly to changes of temperature, and a change of not more than 0.002° C. can easily be measured by means of them. The author has studied the temperature of the brain, comparing it with that of arterial blood, of the muscles, of the rectum, and of the uterus; his observations were made on animals under the influence of morphia or various anæsthetics, and also on man.

The curves of the observations made show that in profound sleep a noise, or other sensory stimulus, is sufficient to produce a slight development of heat in the brain, without the animal necessarily awakening.

In profound sleep the temperature of the brain may fall below that of the blood in the arteries. This is due to the very great radiation of heat which takes place from the surface of the head.

The brain when subjected to the action of the ordinary interrupted current rises in temperature. The rise is observed earlier in the brain than in the blood, and the increase is greater in the brain than in the general blood-current or in the rectum. During an epileptic seizure brought on by electrical stimulation of the cerebral cortex,

G 2

the author observed within twelve minutes a rise of 1°C . in the temperature of the brain.

As a rule the temperature of the brain is lower than that of the rectum; but intense psychical processes, or the action of exciting chemical substances, may cause so much heat to be set free in the brain that its temperature may remain for some time 0.2° or 0.3°C . above that of the rectum.

When a dog is placed under the influence of curare, the temperature of the brain remains fairly high, while that of the muscles and that of the blood falls. The difference of temperature thus brought about is great and constant. In one instance, the temperature of the brain was 1.6°C . above that of the arterial blood in the aorta. Such observations warn us not to regard the muscles as forming, *par excellence*, the thermogenic tissue of the body.

In order to show how active are the chemical processes in the brain, it is sufficient to keep the animal in a medium whose temperature is the same as that of the blood. When the effects of radiation through the skull are thus obviated, the temperature of the brain is always higher than that of the rectum, the difference amounting to 0.5° or 0.6°C .

Observations made while an animal is awake tend to show that the development of heat due to cerebral metabolism may be very considerable, even in the absence of all intense psychical activity. The mere maintenance of consciousness belonging to the wakeful state involves very considerable chemical action.

The variations of temperature, however, observed in the brain, as the result of attention, or of pain or other sensations, are exceedingly small. The greatest rise of temperature observed to follow, in the dog, upon great psychical activity was not more than 0.01°C . When an animal is conscious, no change of consciousness, no psychical activity, however brought about experimentally, produces more than a slight effect on the temperature of the brain.

The author shows an experiment by which it is seen that, as part of the effect of opium, the brain is the first organ to fall in temperature, and that it may continue to fall for the space of eighteen minutes, while the blood and the vagina are still rising in temperature.

The author discusses the elective action of narcotics and anæsthetics. He shows that these drugs suspend the chemical functions of the nerve-cells. In a dog rendered completely insensible by an anæsthetic, one no longer obtains a rise of temperature upon stimulating the cerebral cortex with an electric current. These results cannot be explained as merely due to the changes in the circulation of the blood. The physical basis of psychical processes is probably of the nature of chemical action.

In another experiment, in an animal rendered insensible with

chloral, the curves of temperature show that when the muscles of a limb are made to contract, the temperature of the muscles rises, but falls rapidly as soon as the stimulation ceases, soon returning to the normal. This is not the case, however, with the brain excited by an electric current. Here the stimulus gives rise to a more lasting production of heat; the temperature may continue to increase for several minutes after the cessation of the stimulation, indeed often for half an hour. This may possibly explain why, upon an electric stimulation of the cerebral cortex, the epileptiform convulsions are not immediately developed, but only appear after the lapse of a latent period of several minutes.

This experiment may be made to show the elective action exercised upon the brain by stimulant remedies. The injection of 10 centigrams of cocaine hydrochlorate produces a rise of temperature in the brain of 0.36° C., without any change in the temperature of the muscles or of the rectum being observed. In a curarised dog, the intervention of the muscles being thereby excluded, the action of the cocaine may produce a rise of as much as 4° C. in the temperature of the brain, the author having observed a rise from 37° to 41° C. This shows that in arranging the calorific topography of the organism a high place must be assigned to the brain.

The author concludes by expressing the hope that the comparative study, by the direct thermometric method, of the temperature of the various organs of the body will enable us to push forward our knowledge of the phenomena of life.

Presents, March 24, 1892.

Transactions.

Belgrade:—Royal Servian Academy. Spomenik. Nos. 10, 12, 13.

4to. *Beograd* 1891–92; Glas. No. 30. 8vo. *Beograd* 1891;

Jovan Bak: Jedan Biographski Zapis. 8vo. *Beograd* 1891.

The Academy.

Berlin:—Gesellschaft für Erdkunde. Zeitschrift. Bd. XXVI.

No. 6. 8vo. *Berlin* 1891. The Society.

Bucharest:—Societate de Sciinte Fizice. Buletin. An I. No. 2.

8vo. *Bucuresci* 1892. The Society.

Buenos Ayres:—Museo Nacional. Anales. Entrega 18. 4to.

Buenos Aires 1891. The Museum.

Lausanne:—Société Vaudoise des Sciences Naturelles. Bulletin.

Vol. XXVII. No. 105. 8vo. *Lausanne* 1892.

The Society.

Leipsic:—Königl. Sächs. Gesellschaft der Wissenschaften. Be-

richte (Math.-Phys. Classe). 1891. Heft 4. 8vo. *Leipzig*